

1 **III. Amendment to the Claims.**

2 1. (Original) A continuous process for producing charcoal from biomass input material in
3 which the production of charcoal is maximized and the consumption of charcoal is
4 minimized, the process comprising the steps of:

5 a. establishing a charcoal production bed having a biomass upper layer having a
6 top and a charcoal lower layer having a lower layer top; an intermediate layer pyrolysis
7 zone positioned between the upper layer and the lower layer; the charcoal production bed
8 positioned in a single reaction chamber;

9 b. igniting the lower layer top with ignition means;
10 establishing a pyrolysis zone at the intermediate layer;

11 c. moving oxygen-containing gas downwardly through the charcoal production
12 bed to sustain the pyrolysis reaction in the intermediate layer and to maintain the
13 temperature of the charcoal in the lower layer, wherein the pyrolysis volatiles from the
14 intermediate layer move downwardly through the hot charcoal in the lower layer,
15 resulting in tar-free fuel gas, which exits from the outlet means, and;

16 c. removing, by removing means, charcoal in the lower layer; regulating the
17 introduction of additional biomass material so that as charcoal is removed, the level of
18 charcoal comprising the lower layer, and hence the level of the pyrolysis zone comprising
19 the intermediate layer, remain substantially constant within the reaction chamber.
20

21 2. (Original) The process of claim 1, wherein:

22 a. maintaining the lower layer at a temperature which is sufficiently high to
23 reduce any tars from the pyrolysis zone intermediate layer to carbon monoxide, hydrogen;

24 c. providing the charcoal production bed with an outlet means for fuel gas;
25 regulating the additional biomass material by regulating at least the quantity and or the
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Floyd E. Ivey, USPTO 35552,

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1 moisture content of the additional biomass material.

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3 3. (Original) The process of claim 2, including the step of monitoring the level of the
4 pyrolysis zone in the reaction chamber.

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6 4. (Original) The process of claim 3 wherein the monitoring of the level of the pyrolysis
7 zone in the reaction chamber is by thermocouple means.

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9 5. (Original) The process of claim 2, including the step of removing the fuel gas from the
10 reaction chamber.

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12 6. (Original) The process of claim 1, wherein the temperature of the pyrolysis reaction
13 zone is in the range of 800.degree. C.-1000.degree.

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15 7. (Original) The process of claim 1, wherein the charcoal lower layer is substantially
16 devolatilized.

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18 8. (Original) The process of claim 1, wherein the charcoal lower layer is substantially
19 uniform in size.

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21 9. (Original) The process of claim 2, wherein:

22 a. establishing the charcoal production bed is commenced by adding a charge of
23 charcoal at the lower layer of the reaction chamber.

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25 10. (Currently amended) An apparatus for the production of fuel gas comprising:

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1 a. a reaction chamber receiving biomass, including organic matter, thereby
2 establishing a charcoal production bed; the charcoal production bed having a biomass
3 upper layer having a top and a charcoal lower layer having a lower layer top; an
4 intermediate layer pyrolysis zone positioned between the upper layer and the lower layer;
5 the charcoal production bed positioned in a single reaction chamber; a pyrolysis zone
6 established at the intermediate layer; tar-free fuel gas (44) produced as pyrolysis volatiles
7 from an intermediate layer move downwardly through hot charcoal in the lower layer
8 which exits from outlet means;

9 b. fuel gas (44) output is directed into a heat exchanger means (60) at a heat
10 exchanger tank (60); heat exchanger tank (60) exhaust via a heat exchanger tank exhaust
11 (71);

12 c. heat exchanger tank exhaust (71) is directed into a demister means (80) at a
13 demister input (81); demister means (80) accumulates condensate (83); a demister output
14 (82) is directed into a fuel conditioner means input (110), through a bubble forming
15 means (115) and into and through a fuel conditioner means (100) containing fuel means
16 (120); the fuel conditioner output (130) is exhausted via pump means (140) exerting a
17 vacuum at the fuel conditioner output (130); fuel conditioner output (130) is directed to a
18 storage or combustion at an engine means (160).

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20 11. (Original) An apparatus of claim 10 further comprising:

21 a. having water or coolant supply inlet (67) and water or coolant discharge (69);
22 heat exchanger tank (60) containing water (65); fuel gas (44) bubbled through the water
23 (65) and exhausted from the heat exchanger tank (60) at the heat exchanger tank exhaust
24 (71);

25 b. demister means (80) is comprised of a demister tank (87) with a demister input
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1 (81) comprised of at least one tube (81) extending downwardly toward a condensate (83)
2 collector (85);

3 c. the fuel conditioner means (100) contains fuel means (120); bubble forming
4 means (115) is provided by directing the fuel conditioner input means (110) via pipe or
5 tube means (110) to and through a grid (116) formed of fine wire mesh or a plate with at
6 least one aperture (117); the bubble forming means (115) is submerged beneath a fuel
7 means (120) surface (125).

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9 12. (Original) An apparatus of claim 11 further comprising:

10 a. heat exchanger means (60) is supplemented by a supplemental heat exchanger
11 means (62); said supplemental heat exchanger means (62) is positioned within the heat
12 exchanger tank (60) and is in fluid contact with the heat exchanger water or fluid content
13 (65);

14 b. the at least one tube (81) is comprised of a plurality of tubes 1...n (81); the
15 condensate (83) accumulated in the demister means (80) is periodically drained from the
16 demister means (80) by a condensate drain means (84) comprised generally of a valve and
17 piping means discharging into a reservoir.

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19 13. (Currently amended) An apparatus of claim 12 further comprising:

20 a. supplemental heat exchanger means (62) is comprised of a tube heat exchanger;
21 fuel means (120) includes but is not limited to diesel, peanut oil, vegetable oils and other
22 combustible substances for engine means (160) combustion/ pump means (140) exerts a
23 vacuum at the fuel conditioner output (130) and fuel conditioner output (130) is directed
24 to a storage or combustion at an engine means (160);

25 b. [V]__valve means controls water or coolant supply inlet (67) and water or
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1 coolant discharge (69) and the condensate drain (84); pipe or tube means (75) provides
2 fluid communication from fuel gas (44) input to heat exchanger means (60), between heat
3 exchanger means (60) and demister means (80); between demister means (80) and fuel
4 conditioner means (100) and between fuel conditioner means (100) and storage or engine
5 means (160).

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7 14. (Currently amended) An apparatus of claim 13 further comprising:

8 a. the fuel conditioner output (130) is in the range of 5% to 20% diesel with the
9 balance comprised of fuel gas (44);

10 b. conditioner means (100) having a fuel conditioner means input (110) from the
11 demister means (80) conveying fuel gas (44); the fuel conditioner means input (110)
12 directing fuel gas (44) through bubble forming means (115) into and through a fuel
13 conditioner means (100) containing fuel means (120);

14 c. bubble forming means (115) is provided by directing the fuel conditioner input
15 means (110) via pipe or tube means (110) to and through a grid (116) formed of fine wire
16 mesh or a plate with at least one aperture (117).

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18 15. (Currently amended) An apparatus of claim 14 further comprising:

19 a. the fuel conditioner output (130) will be diesel in the range of 5% to 10% and
20 fuel gas (44) at 95% to 90%;

21 b. fuel means (120) comprised of diesel, peanut oil, vegetable oils and other
22 combustible substances.

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24 16. (Original) An apparatus of claim 15 further comprising:

25 a. the conditioned fuel gas (130) is be introduced directly into the engine intake
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1 manifold.

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3 17. (Original) An apparatus of claim 11 further comprising:

4 a. the water or coolant discharge (69) is discharged to a reservoir for agricultural
5 uses.

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7 18. (Original) A process from the apparatus of claim 17 comprising:

8 a. collecting the water or coolant discharge (69); separating chemicals from said
9 water or coolant discharge including potassium.

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11 19. (Currently amended) The apparatus of claim 10 further comprising:

12 a. the upper layer (13) has a upper layer center (12) relative to the upper layer
13 (13) proximal a reaction chamber wall (32) and proximal [the] a reaction chamber top
14 (31);

15 b. biomass (20) is introduced into the upper layer (13) by means of a funnel
16 means (200) which directs said biomass (20) toward the upper layer center (12);

17 c. a charcoal discharge funnel means (230) is formed intermediate the lower layer
18 (15) and the removal means (45) which directs the charcoal away from walls (42) of the
19 charcoal removal system (40) and toward the removal means (45);

20 d. the funnel means (200) at the funnel side (220), relative to a vertical, and the
21 charcoal discharge funnel means (230) at the charcoal discharge funnel slope (240) are
22 sloped at greater than approximately 45 degrees[;]_____

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24 20. (Original) The apparatus of claim 19 further comprising:

25 a. the slope, θ (210, 240) of the funnel means (200) funnel side (220) and of the
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1 charcoal discharge funnel slope (240) are approximately 60 degrees; both the funnel
2 means (200) and the charcoal discharge funnel means (230) are primarily inverted conical
3 in structure.

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5 21. (Original) The apparatus of claim 12, further comprising:

6 a. a charcoal heat exchanger means (260) provided by at least one tube (262)
7 penetrating the charcoal collection means (41) arena via heat exchanger ports (264) at the
8 charcoal removal system wall (42).

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